

We have proposed a range of analytic approaches for assessing each of the attributes of the RCRA Subtitle C prevention program; these approaches differ in analytic scope, level of resources required, and in the level of certainty of results. Below we first discuss these key characteristics of each of the three major approaches we have outlined. We then provide brief discussion of potential additional steps in methodology development for RCRA Subtitle C.

8.1 OVERVIEW OF THE PROPOSED APPROACHES

We provide four alternative approaches to estimating the benefits of the RCRA program associated with regulations that govern the operation of TSD facilities and the disposal of hazardous waste. While all of the approaches would provide quantitative estimates of selected benefits associated with the program, they differ in the level of resources they require, the universe of facilities they address (e.g., "avoided" TSDs), and the certainty of their results. In addition, because the approaches focus only on a subset of attributes, a comprehensive assessment of the benefits, impacts and costs of RCRA based on any of these approaches would also require separate analyses of long-term benefits, short- and long-term costs, distributional impacts of the program, and program context attributes identified in the OSWER framework. Exhibit 8-1 provides a summary of the scope of the benefits approaches (i.e., Approaches A, B, and C, and D) and also summarizes the scope of the separate analytic approaches recommended for the national-level attributes.

Exhibit 8-1		
SUMMARY OUTLINE OF RESULTS OF PROPOSED METHODOLOGIES		
Attributes	Approach A	Pathway Modeling Approaches (B, C, and D)
BENEFITS		
Scope of Analysis	"Avoided Hazardous Waste Sites" in industries described in <i>Industry Assessments</i> , landfills	Improved practices at operating TSDs with pre-RCRA Solid Waste Management Units, and benefits of avoided TSDs
Human Health Benefits	▶ Single estimate of value of "Avoided Hazardous Waste Sites" based on avoided property value losses and avoided costs of government-mandated cleanup	▶ Modeled estimate of cancer, non-cancer risk reduction, disease case reduction, population threshold exceedance reduction; ▶ Modeled estimate of MEI risk reduction ▶ Estimate of number of avoided acute events
Ecological Benefits		▶ Modeled estimate of avoided surface water, soil contamination incidents, lost use values
Avoided Costs		▶ Monetized estimate of avoided government-mandated replacement costs for contaminated groundwater
Aesthetics and Historical Preservation		▶ <u>Aesthetics</u> : Proximity, trend analysis of homes reporting "smoke, odor" and RCRA sites ▶ <u>Historic Preservation</u> : Proximity, trend analysis of historic areas, RCRA facilities
Long-Term Benefits (Sustainability)	▶ <u>Avoided damages over long time horizons and increases in damages due to changes in affected populations</u> : quantitative modeling estimates of avoided damages (<i>not possible using Approach A information</i>) ▶ <u>Benefits associated with the precautionary principle: protection from unforeseen issues</u> : Qualitative analysis of past costs of unrecognized hazards, effectiveness of original RCRA rules at addressing "new" wastes ▶ <u>Benefits from potential long-term increases in the value of environmental quality</u> : quantitative estimate of volume of groundwater contamination avoided under RCRA; qualitative discussion of issues involved with valuing long-term benefits	
COSTS		
Compliance Costs	▶ Monetized estimates of total compliance costs based on <i>Cost of Clean</i> , PACE data	
Government Costs	▶ Monetized estimates of total program costs based on <i>Cost of Clean</i> data	
Long-Term Costs	▶ Qualitative discussion of potential long-term costs	
DISTRIBUTIONAL IMPACTS		
Intra-generational Economic Equity	▶ <u>Public/Private Equity</u> : Comparison of distribution of public/private funds expended under Superfund, RCRA Corrective Action, and RCRA prevention programs ▶ <u>Improved Competition</u> : Qualitative discussion of value of improved competition; assessment of number of facilities meeting compliance standards pre-RCRA	
Environmental Equity	▶ Literature review identifying negative siting effects of RCRA	▶ Geographic analysis of changes in demographics near RCRA sites over time
Economic Impacts	▶ Estimate based on trend analysis and sample facility analysis to identify changed practices	
Risk Tradeoffs	▶ Estimated number of additional accidents due to increased vehicle miles traveled for accident related costs associated with transportation (other risk tradeoffs negligible)	
Long-Term Impacts: Inter-generational Equity	▶ Total and percentage reduction in land disposal quantities and facilities ▶ "Cleanup delays avoided" by RCRA monitoring requirements	
PROGRAM CONTEXT ATTRIBUTES		
Technology Forcing	▶ Qualitative analysis based on indicator analysis and survey of hazardous waste technology suppliers to identify drivers, customers of rapidly developing technologies	
Reinvention Initiatives	▶ Programs too recent to have measurable effect for a retrospective analysis; qualitative discussion of potential impacts	
Constraints	▶ Qualitative analysis of the effects and limitation of various court, legislative acts	
Stakeholder Issues	▶ Qualitative analysis of intensity of feeling and value of information collected and available under RCRA	
Long-Term Effects: Behavioral Change	▶ Qualitative discussion of extent of capital investment in pollution control	

8.2 KEY CHARACTERISTICS AND LIMITATIONS OF THE APPROACHES

Our proposed benefits approaches provide an estimate of selected benefits and impacts of RCRA that are associated with avoided hazardous waste releases from TSD facilities. The four benefits approaches use different methodologies to develop estimates that consider human health benefits, ecological benefits, and avoided government-mandated costs associated hazardous waste sites. Below we summarize key characteristics of these approaches, including resource and data requirements, flexibility, and limitations. In addition, we summarize the approaches we have outlined for addressing the potential long-term benefits, social costs, distributional impacts, and program context attributes for the RCRA Subtitle C program.

8.2.1 *Approach A: The Simple Property Value Estimate*

Approach A would provide a low-end estimate of RCRA benefits and impacts based on a relatively limited level of data and resources. The approach would be limited to an assessment of: 1) the attributes reflected in property value effects; and 2) the averted government-mandated cleanup costs that would be associated with hazardous waste sites avoided due to the closure of pre-RCRA TSDs. Property value changes related to proximity to a hazardous waste site may reflect property owners' evaluations of multiple characteristics, including human health risk (from contaminated wells as well as acute incidents), ecological damage, cost of alternative water supplies, and economic effects such as changes in employment opportunities. However, the extent to which property values accurately capture these attributes (and therefore the extent of overlap) is uncertain. For example, property value benefits may not entirely account for human health risk in cases where property buyers are not fully informed about contamination or risk associated with a site. Alternatively, property value effects may exceed the total value of other benefits if perceived contamination and risk exceeds actual levels. Because of both the potential overlap and the uncertainty associated with property value benefits, we suggest using this attribute as a general alternative method for calculating a set of benefits, and do not recommend "adding it" to other attributes.

The analysis would provide only a lower bound of benefits because it does not consider the benefits of changes in practice at TSDs that continued in operation. An additional limitation of the approach is the inability to identify the contribution of specific benefits or impacts to the total property value. However, this approach may provide a relatively inexpensive initial indication of the potential extent of total RCRA benefits, and may suggest that the potential benefits of RCRA are significant enough to merit a full-scale analysis.

8.2.2 *Approach B: Pathway Modeling Approach Using Corrective Action RIA Facility Data*

Approach B is a more sophisticated approach to identifying the benefits associated with changes in practice at TSDs under RCRA. Approach B would extend the scope of Approach A to

address the incremental benefits of improved waste management practices at operating TSDs, as well as the benefits associated with TSD closure. Approach B would use accepted multi-pathway modeling methods and facility data developed and peer reviewed for the *Corrective Action RIA*; by basing the analysis on this previous effort, Approach B could provide some national-level estimates without undertaking the expense and effort associated with sample selection and full model development and calibration. However, even with previously collected data, this approach would be considerably more resource intensive than Approach A because it would require verification and updating of previous modeling protocols and development of new modeling scenarios.

While the analytic scope of Approach B is broader than that of Approach A, it is limited to examination of TSDs and wastes that were originally addressed under RCRA Subtitle C because the *Corrective Action RIA* sample identifies only facilities with SWMUs that ceased operation by 1982. In addition, the extent of nation-level analysis describing the benefits of RCRA prevention would be limited by the characteristics of *Corrective Action RIA* sample facilities, and the extent to which the actual facilities in this sample are truly representative of the broader RCRA universe.

8.2.3 Approach C: Pathway Modeling Approach Using Original Data Collection and Modeling

Approach C would use modeling approaches like those described in Approach B to estimate the same benefits attributes, but based on an original data collection and modeling effort. This would provide additional flexibility in establishing the scope of the program analysis to virtually any type of facility affected by RCRA. However, it would require considerable additional resources, particularly if implementation required selection of a nationally representative sample of facilities. Depending on the size of the sample collected for this approach an ICR may be necessary.

8.2.4 Approach D: Pathway Modeling Approach Using HWIR 3MRA Modeling

Approach D would construct an industry level "without-RCRA" scenario of waste generation in the absence of RCRA. The approach would then use the HWIR 3MRA model to provide national estimates of human health and ecological benefits associated with disposal of without-RCRA wastes in the sample facilities incorporated into the HWIR model. This approach would eliminate the need for selecting a representative sample of facilities, but it might require considerable resources to undertake an original modeling effort, and would demand careful attention to the representativeness of the facilities in the HWIR model. The HWIR model reflects information from 200 representative Subtitle D (i.e., nonhazardous) industrial disposal facilities; this model is undergoing peer-review but has not been used in a program-level assessment comparable to the approach outlined here.

Like Approach B, Approach D would not automatically address new wastes and industries regulated after 1980 (i.e., because the without-RCRA scenario is based primarily on industry

information related to the earliest Subtitle C listings), but the model could be adjusted to reflect new wastes using the same sample disposal facilities and more recent industry information. Exhibit 8-2 summarizes the key differences among the modeling approaches.

Exhibit 8-2 COMPARISON OF MODELING APPROACHES TO ESTIMATING BENEFITS OF RCRA SUBTITLE C*		
Feature of Approach	Approach B	Approach D
Industries Addressed	1970s industry studies and 79 Corrective Action sample facilities	1970s industry studies and 3MRA industrial database (17 industries)
Waste Management Units Addressed	Landfills, Land Treatment Units Waste Piles Surface Impoundments Tanks Incinerators Injection Wells Waste Transfer Stations Waste Recycling Spill Areas Accumulation Areas Process Sewers	Landfills Land Application Units Waste Piles Surface Impoundments Aerated Tanks
Disposal Locations Addressed	Locations where hazardous waste actually disposed	Industrial Subtitle D locations, linked to specific industry
Representativeness of Disposal Locations	On site - small number of sites represents industry	Off site - sites represent all waste disposal locations for industry
Methods for Damage Functions	Pathway modeling using MMSOILS; Separate risk assessment required	Risk assessment modeling using 3MRA
Peer Review Status	Corrective Action Approach (including use of MMSOILS) peer reviewed; reservations noted	3MRA undergoing peer review; no comparable project using 3MRA
Resources Required	Update of MMSOILS, without-RCRA scenario of continued disposal required	Model calibration, scenario development required for both scenarios
<p>* Approach C, as a original modeling effort, may address a range of industries, waste management units, and disposal locations, and may involve one or more of several different pathway and risk assessment models with damage function methods. Therefore, we do not attempt to compare it with the more specific approaches outlined in Approaches B and D.</p>		

8.2.5 Approaches to Addressing Remaining Attributes

In addition to the approaches outlined above for assessing exposure-related benefits, a complete assessment of the RCRA Subtitle C Prevention and Waste Minimization programs requires separate analyses that address long-term benefits, social costs, distributional impacts, and program context attributes. Below we briefly summarize the methods we have proposed for assessing these additional benefits, costs, and other program impacts. The approaches we have outlined for these attributes are generally less resource intensive (even in total) than the modeling approaches outlined above; however, certain optional approaches we have suggested may require an ICR. Detailed descriptions of data requirements are available in Chapters 4 through 7.

- **Long-Term Benefits:** We propose four separate analyses to address potential long-term benefits of RCRA prevention programs. These include discussions of three potentially measurable program outcomes (i.e., avoided exposure over long time periods, avoided increased exposure resulting from changes in affected populations, and avoided damages from unforeseen events or issues), and a separate discussion addressing recent and potential changes in consumers' willingness-to-pay for environmental quality (this issue will ultimately affect the value of all potential long-term benefits). Our methods primarily involve qualitative discussions of attributes, supported when possible by quantitative estimates illustrating the potential magnitude of long-term impacts (e.g., quantity of groundwater protected).
- **Social Costs:** We propose to estimate the monetary value of compliance and government-sector program costs using EPA's forthcoming *Cost of Clean*; however, we provide an alternative approach to estimating compliance costs to address a supplemental or industry-specific examination that requires more detailed sector data than provided in *Cost of Clean*. We also propose a qualitative assessment of the potential long-term costs related to RCRA, including costs related to missed opportunities to take advantage of technological change or to invest in more productive long-term activities.¹
- **Distributional Impacts:** We propose methods for addressing five key distributional impacts of RCRA: intra-generational economic equity; environmental justice, economic impacts, risk tradeoffs, and long-term (inter-generational) distributional impacts. For each of these attributes we suggest approaches that would provide a qualitative discussion accompanied by quantitative estimates of the magnitude of the potential impact.

¹ Due to the lack of baseline information about pre-RCRA hazardous waste management, we do not attempt to identify net social welfare losses and transitional social costs related to RCRA; we discuss the distributional aspects of these attributes in our discussion of intra-generational equity.

- **Program Context Impacts:** We propose qualitative discussions (again, where possible supported by quantitative indications of magnitude) for five program context attributes, including impacts related to regulatory reinvention, regulatory constraints, stakeholder issues, technology forcing activities, and impacts related to long-term behavioral changes. While the regulatory reinvention and technology forcing attributes may ultimately be associated with measurable benefits, existing information is insufficient to isolate and measure these impacts. The remaining three attributes address program issues and characteristics that provide insight into the prioritization of RCRA activities.

8.2.6 *Use of Approaches to Describe Performance Under GPRA*

Certain of the methods we have proposed may be useful in evaluating OSWER's success in meeting long-term GPRA subobjectives for the RCRA Subtitle C and hazardous waste minimization programs. Below we summarize the key analyses that would be most supportive of the stated goals:

RCRA Subtitle C: OSWER's 2005 subobjective is to have permits or approved controls in place to prevent dangerous releases to air, soil, and groundwater at 85 percent of hazardous waste management facilities located in the United States, its territories, or on tribal lands.² To the extent that the modeling approaches outlined above can provide average "per-facility" estimates of the benefits related to implementation of RCRA Subtitle C regulations, these approaches can likely be used to evaluate the benefits of achieving this goal (though Approach C would only be appropriate if it involved a nationally representative sample of facilities). Approach A provides only a summary estimate of benefits; this approach would not provide specific release estimates or benefits assessments needed to properly support the specific objective. In addition to benefits analyses, the quantitative evaluation of environmental justice and intra-generational economic equity and the qualitative discussion of potential long-term benefits may provide additional information about the impacts of achieving this goal.

² The baseline used to develop this estimate includes facilities that manage hazardous waste (in addition to Subtitle D facilities managing non-hazardous waste) and addresses facilities that are currently in compliance with permits (i.e., are currently in BRS but require updates to permits or systems) as well as facilities that do not have RCRA permits in place (i.e., are not in BRS but are in RCRIS or other available data sources. Using the information sources and categories that EPA used to develop the baseline, it should be possible to assess the potential benefits associated with the Subtitle C facilities (but not the Subtitle D facilities); the bulk of potential benefits will likely be associated with changes at those facilities who do not have final RCRA permits in place.

Waste Minimization: OSWER's 2005 subobjective is to reduce the priority PBT waste volumes in hazardous waste streams by 50 percent from 1991 levels. Several of the proposed approaches would reflect the current achievements under waste minimization programs as part of the overall benefits of Subtitle C, but it is difficult to isolate and quantify the specific health and ecological benefits related to this program, due in part to its relatively recent development. However, our proposed methods for addressing program context attributes identify a qualitative assessment of the potential benefits associated with the program; these include reduced costs associated with disposal and maintenance of disposal facilities; reduced demand for the creation of waste disposal sites (which are widely regarded as "disamenities" by local communities), and reduced possibility for acute events and cross-media transfer of waste.

The value associated with waste minimization depends critically on the level of risk that is associated with Subtitle C waste management. Therefore, to estimate risk reduction associated specifically with decreases in both total hazardous wastes and PBT wastes, it is necessary to identify Subtitle C-related risk. Our modeling approaches make the initial assumption that this risk is insignificant, but we recommend that this assumption be examined closely during implementation. To the extent that we can define risk associated with management of waste under RCRA Subtitle C, we can estimate the benefits associated with decreasing this risk. Note, however, that it may be difficult to attribute waste reduction specifically to waste minimization programs.

8.3 POTENTIAL DOUBLE COUNTING OF BENEFITS, COSTS AND DISTRIBUTIONAL IMPACTS

One step in aggregating the results of analyses for different attributes would be to address potential double counting of benefits, costs, or distributional impacts that could occur through implementation of the full suite of approaches. This document presents a variety of potential approaches to assessing various attributes; the extent to which actual analyses overlap will depend on the selection and implementation of specific approaches. In most cases we have attempted to clearly define attributes and analyses in order to minimize potential overlap. However, below we identify three areas of analysis which require careful attention to assure that overlap is avoided.

8.3.1 *Human Health, Avoided Costs of Alternative Water Supplies, and Avoided Government-Mandated Remediation Costs*

The human health and avoided cost attributes both address (in different ways) the value that is associated with avoiding health effects (i.e., since averting actions should reduce risk of exposure to contaminants). Therefore, when estimating potential exposure or avoided costs it is important to identify when averting behavior would begin and adjust the exposure levels accordingly, and it is also important not to "double count" these impacts by adding them together.

There is one case in which avoided costs can be added to health impacts; that is the specific case in which other existing regulations would have required a response (e.g., a mandatory requirement for a water treatment system or for cleanup). If a clear response would have been mandated, then both the health effects (reflecting exposure until government actions are taken) and the costs of the mandatory response are avoided under the regulation, and these avoided effects should be reflected in the benefits of the program.

8.3.2 *Technology Forcing, Behavioral Change, and Regulatory Reinvention Programs*

Technology forcing effects address the extent to which a program supports or encourages the development and adoption of improved technologies; the adoption of these technologies could, in fact, be associated with real benefits (i.e., through cost reductions or risk reductions). Similarly, behavioral change can include permanent shifts in technology, and regulatory reinvention programs can include cost reduction measures such as technology development. Any attempt to quantify or value the outcomes associated with these attributes could potentially result in double counting. To eliminate the potential for double-counting in our proposed approaches, we present qualitative methods for discussing these three attributes as program context attributes, and do not attempt to quantify or evaluate impacts. Also, because regulatory reinvention is relatively recent and because identification of "permanent" behavioral change requires a long time-horizon, there is little information specifically addressing these attributes at this time. However, as new information about these areas becomes available, it may be necessary to revisit the issue of double-counting.

8.3.3 *Stakeholder Issues and Long-Term Benefits*

"Intensity of feeling" is one of the key attributes describing stakeholder issues. This attribute can reflect both short-term and long-term concerns among stakeholders, but stakeholder involvement in hazardous waste policy making often reflects considerable concern for long-term (often inter-generational) risks associated with waste management. As a result, intensity of feeling can provide an indicator of the emphasis (and potential value) that the public places on long-term risks and benefits. Our proposed method for addressing intensity of feeling does not attempt to value or quantify the extent of stakeholder concerns about hazardous waste, so there is no specific issue related to double-counting of these outcomes with long-term benefits. However, to avoid the potential for over-emphasis of this issue, it is important to maintain the distinction between the program context attributes (which help describe program priorities and limitations) and attributes that measure actual benefits.

8.4 CONCLUSIONS AND NEXT STEPS

The benefits approaches we have outlined provide a starting point for an assessment of the entire RCRA Subtitle C prevention program. These approaches would each provide an assessment of the benefits associated with TSD facilities, which we believe to be a major portion of the benefits and impacts of the program. Moreover, these approaches present a range of analytic options that are responsive to the range of program and analytic priorities that may be involved in a national analysis of the benefits, impacts and costs of the RCRA Subtitle C program.

However, while we believe that these methods can provide plausible results for a national assessment of RCRA Subtitle C, we suggest the following potential adjustments to the scope of the analysis to address issues that are not incorporated into our current approaches:

- **Adjust Scope of Analysis to Address Changes in Generator Practices**
While the impacts of some changes in generator practices (such as waste minimization) are reflected in the development of the "without-RCRA" scenarios in various attributes, other generator practices (i.e., improved storage practices that result in fewer releases and reduced damages) are not addressed directly by the proposed methodologies.
- **Adjust Scope to Include Additional Industries and Wastes:** Although Approach C provides the flexibility for addressing facilities subject to regulation after 1980, Approaches A, B, and D, as described, are limited to the original wastes regulated under RCRA.
- **Adjust Benefits, Impacts and Costs to Reflect State Program Activities:**
The proposed approaches do not specifically address the contribution of state hazardous waste prevention programs, including those that were "RCRA-inspired," (and should be included in the benefits and costs of the RCRA program) and those that pre-dated RCRA (and should not be included in an assessment of the RCRA program).
- **Address (and Refine, if Necessary) Baseline Assumption that Subtitle C Waste Management is Risk-Free:** Our modeling approaches make the initial assumption that this risk is insignificant, but we recommend that this assumption be examined closely during implementation. To estimate risk reduction associated specifically with decreases in both total hazardous wastes and PBT wastes, it is necessary to identify Subtitle C-related risk.

The adjustments above may have varying impacts on the total estimate of the benefits, impacts and costs of the RCRA program, and would require varying levels of effort to address in the context of the different proposed approaches. Therefore, we recommend that the importance of each of these potential adjustment be considered if methodology development progresses.

Addendum to:

***Approaches to Assessing
the Benefits, Costs, and Impacts of the
RCRA Subtitle C Program***

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Introduction

The following pages contain excerpts from a draft August 2001 project plan prepared by the OSWER Office of Solid Waste (OSW), which describes a potential strategy for assessing the benefits of RCRA Subtitle C hazardous waste standards. This plan was the basis for modeling approach “D” that is described in section 3.5 of the “Approaches to Assessing the Benefits, Costs, and Impacts of the RCRA Subtitle C Program” and provides a more detailed explanation of the methodology for developing “with and without RCRA” scenarios.

Project Description

The project will provide a descriptive account of the benefits of RCRA waste management practices. The report will quantitatively describe the changes in waste generation and management that are attributable to adoption of these practices.

This assessment of changes in waste management can then be used to develop more precise economic estimates of the benefits of RCRA waste management standards.

Objectives

The objective of the project is to describe the benefits of RCRA waste management standards. The assessment of benefits will be based on a comparison of two scenarios:

- A baseline scenario, describing waste generation and management practices under existing RCRA standards today.
- A counterfactual scenario, describing waste generation and management practices as they *would be* today *in the absence of* existing RCRA standards.

RCRA benefits are assessed based on an evaluation of the differences between these two scenarios: differences in risk to human health and the environment, difference in esthetic impacts, differences in damages to ecological resources and recreational and commercial activities.

These scenarios will be developed for a series of industries that generate hazardous waste. The improvements in waste management will be described for each industry individually, and then in aggregate.

Methods

Step One: Determine Relevant Industries and Available Data

The aim of this step is not to obtain a representative sample of industries, but rather to select a number of industries that would, in the aggregate, compose a significant proportion of hazardous waste generation. A complete assessment of benefits would entail evaluating all industries that generate hazardous waste. This project, owing to limitations on data and other resources, will instead seek to assess a large (but not total) proportion of benefits; the results are therefore, by design, *underestimates* of the benefits of hazardous waste management standards.

Among the criteria for selection of industries:

Availability of data: In order to understand waste management practices in the absence of RCRA, OSW needs to characterize waste management before RCRA (see step 2). Availability of pre-RCRA waste management information is an important limiting factor in selection of industries; an initial set of industries with data is noted under Step 2.

Significant waste generation: Industries which do not produce large amounts of waste are less likely to affect the overall picture of waste management.

Step Two: Characterize Waste Generation and Management in the Pre-RCRA Scenario

For each industry selected, OSW will create a characterization of waste generation and management techniques, *as practiced before the advent of RCRA regulations*¹. The data will be presented with the same data elements as in the baseline scenario.

¹ The exact year of the pre-RCRA scenario will be determined by the availability of data. It will most likely be approximately 1975, just before the passage of the RCRA statute.

An important source of data for the pre-RCRA scenario will be industry profiles created for the Office of Solid Waste Management Programs in the late 1970's. These reports profiled generation and management of hazardous waste in a selection of industries:

< Organic Chemicals	< Non-Ferrous Smelters
< Inorganic Chemicals	< Electroplating
< Pharmaceuticals	< Special Machinery
< Pesticides	< Electronic Components
< Explosives	< Batteries
< Petroleum Refining	< Rubber and Plastics
< Petroleum Re-refining	< Leather Tanning
< Iron & Steel	< Textiles

Other industries which were not included in those profiles may also be good candidates, if data is available.

For each industry selected, the next step in the project is to create a scenario describing waste generation and management in a pre-RCRA year (prior to promulgation of RCRA regulations); this year will probably be approximately 1975-1976. For each industry, the pre-RCRA scenario will note what wastes are generated, in what volumes, in what forms, what are the constituents, and how are they managed. Much waste management in these scenarios is likely to consist of environmentally risky methods such as unlined landfills, lagoons, and simple surface dumping.

Existing data sources should be sufficient to provide information about waste generation and management. Much of the data (for the 1970s studies) was collected to learn how waste was managed; the resulting reports provided information about the threats posed by mismanaged hazardous waste.

This data will need to be updated by including data on wastes which were *generated* in the pre-RCRA year, but were not yet *tracked* (or identified as hazardous) by the RCRA program. By bringing together data from a variety of sources, it should be possible to create a reliable and reasonably accurate scenario describing hazardous waste management before RCRA management

practices were employed.

Step Three: Characterize Waste Generation and Management in the Baseline Scenario

With each selected industry, OSW will create a characterization of current waste generation and management techniques. The characterization will include:

- < Waste streams generated
- < Quantities generated of each waste stream
- < Chemical constituents of each waste stream, and constituent concentrations
- < Waste codes
- < Management practices, including treatment and disposal units.

Waste management in the baseline scenario is expected to consist largely of safe and preventive practices, such as advanced treatment to destroy or immobilize constituents, followed by disposal of residuals in approved management units such as lined, covered landfills.

Step Four: Characterize Waste Generation and Management in the Counterfactual Scenario

Working from both the pre-RCRA scenario and the baseline scenario, the next task is to create the counterfactual scenario, which represents waste management today *as it would be* in the absence of RCRA standards. This is obviously a more difficult task than the pre-RCRA or baseline scenarios.

Waste management: The premise of the counterfactual scenario is that waste management today would be similar to waste management pre-RCRA, in the absence of waste management standards.² To the extent that there are differences in waste management from the pre-RCRA scenario to the baseline scenario, therefore, OSW will assume continuation of the pre-RCRA

²This does not mean that OSW is assuming that there would be no safe waste management in the absence of RCRA legislation or regulations. See the discussion under "Scope and Assumptions."

management, unless some event or requirement exogenous to RCRA standards had caused that change in management technique.

Waste generation: Estimating what wastes would be generated today, and the characteristics of those wastes, requires an extrapolation based on the pre-RCRA scenario and the baseline scenario. To the extent that there are differences in the wastes generated in those scenarios, OSW will need to determine whether those differences are caused by changes in waste management standards. Changes in waste generation (from the pre-RCRA scenario to the baseline scenario) that are caused by other environmental statutes (e.g., restrictions on pesticides from the Federal Insecticide, Fungicide, and Rodenticide Act) or changes in technology or changes in the economy will be represented in the counterfactual scenario; although RCRA standards are not assumed to exist in the counterfactual, all other environmental programs are assumed to exist. Changes in waste generation that are caused by RCRA waste management standards (e.g., reduced toxicity from treatment requirements) will not be represented in the counterfactual scenario.

Determining waste generation and characteristics will require a careful estimation, examining actual generation in each year as well as industry trends, other regulatory initiatives, and economic factors that influenced industrial production and waste generation in each year.

The end product of this task will be a scenario describing generation and management of hazardous waste *as it would be today*, if RCRA management standards were not in place. The same data elements (e.g., quantities, constituents, management techniques) will be determined for the counterfactual scenario as are used for the other two scenarios.

Step Five Assessment of RCRA Benefits

In this final step, the benefits of RCRA waste management standards are qualitatively described, based on analysis of the differences in waste generation and management between the baseline and counterfactual scenarios.

Scope and Assumptions

This report is *not* predicated on an assumption that the federal RCRA program is the sole cause of the benefits identified. Certainly, some hazardous wastes were being managed in an environmentally responsible manner even before the proposal of RCRA regulations in 1978, and even before the federal RCRA legislation in 1976.

It is also clear that industrial waste managers follow safe waste management protocols for a variety of reasons, regardless of the existence of federal regulations or enforcement:

- < Many states and localities have regulations on waste management that are independent of RCRA.
- < Facilities may seek to avoid liability under CERCLA or similar statutes.
- < They may seek to comply with requirements of their insurers (or lower their insurance premiums).
- < Most facilities are inclined to take actions that will gain them goodwill with nearby communities, who may have concerns about the effects of poor waste management practices.

OSW is not prepared to determine the degree to which federal regulations drive waste management practices, in comparison with these other motivations. Therefore, this project will not assess the benefits of the federal RCRA program, *per se*. Rather, this project is intended to assess the benefits of implementing safe waste management practices, as represented by the management standards of the RCRA program.

Without attributing causality, though, the study methodology does exclude waste management improvements which cannot plausibly be connected to RCRA at all. The study therefore specifically excludes consideration of industries that manage waste safely before RCRA, as well as industries that have not come under RCRA authority. This latter category includes industries which have not had significant wastes listed as hazardous (for example, pulp and paper, or paint manufacturing).

Exclusion of these industries will not bias the results. The report will provide a snapshot of waste management based on aggregated industries, not based on a representative sample. Therefore, the benefits of RCRA are *at least* as great as those described in this report. If those other industries were included, they would not *decrease* the benefit estimate.

Future Efforts

Once baseline and counterfactual scenarios exist for all the industries, the next phase of the project can begin. In that phase, OSW will assess the implications of the differences between the two scenarios.

Chronic Human Health Damages Avoided or Reduced: Using existing EPA models, assess the cancer and non-cancer risks associated with the counterfactual scenario.

For example, the Multimedia, Multipathway, MultiReceptor Risk Assessment (3MRA) model could be used to project damages resulting from management of wastes in the counterfactual scenario.

Acute Events Avoided or Reduced: The inferior management standards in the counterfactual scenario are anticipated to lead to more frequent acute events such as explosions, fires, and toxic gas clouds. OSW can assess reductions in injuries, deaths, and resource damages resulting from such events. Such events occur in the baseline scenario as well, so the assessment of benefits stems from the reduced number of events compared to the counterfactual.

Resource Damages Avoided or Reduced: The waste management practices in the counterfactual would be expected to result in greater releases of hazardous chemicals than under the baseline. These releases would result in damages to recreational and commercial activities, negative esthetic impacts to residential areas, damages to ecological services, and to non-use values for resources.

Response Costs Avoided or Reduced: Smaller and/or less frequent releases in the baseline should translate to savings in averting expenditures and in remediation costs.